

Network Status Server, Information Distribution System,
Control Method, and Storage Medium
for Storing Control Program

5 BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a network status
server for distributing large-capacity data on a
network, an information distribution system, a control
10 method, and a storage medium for storing a control
program.

Particularly, the present invention relates to a
network status server, an information distribution
system, a control method and a storage medium for
15 storing a control program when a plurality of
dispersed/arranged information distribution servers are
controlled.

Related Background Art

As one of information distribution techniques
20 using Internet, World Wide Web (hereinafter referred to
as Web) has generally been used. This technique
comprises: operating a web server software on a general
computer (information processor); and distributing
information such as contents (characters, charts,
25 tables, and the like) described in an HTML language.
The computer as a client which accesses a server
(hereinafter referred to as the access client) may be

connected to the server via a network, and free perusal
is possible with a general-purpose perusal software
(browser). In recent years, a web server site
accessible to the entire world has appeared and the
5 importance has further increased. On the other hand,
when the web server has been accessed from the entire
world in a concentrated manner, a large load is applied
to the connection network, and the web server. To
solve the problem, several techniques are currently
10 proposed as countermeasures. The techniques will
briefly be described with reference to Figs. 6 and 7.

First, a system in which a virtual host computer
is utilized as shown in Fig. 6 is proposed as a
technique of dispersing accesses concentrated to the
15 web server. This aims at dispersing the above-
described load to a plurality of servers. In this
example, it is supposed that the access client accesses
URL (access address) of www.abcde.jp. In the access to
www.abcde.jp, first the virtual host computer is
20 accessed. The virtual host computer intends to
appropriately disperse the accesses from the load
situation of the respective subordinate web servers.
Actually, any one of www1, www2, www3 distributes
predetermined information in response to the access
25 from the client, but the virtual host computer once
accepts the access to appropriately disperse the
access. Moreover, a transfer system by TCP connection

hop is proposed. The system will be described with reference to Fig. 7. When there is an access from the client, first www1 is accessed. In the www1, a scheduler operates, and selects the optimum web server
5 www3, and responds to the access from the client. Specifically, the www1 constantly responds to an access request, and the optimum web server (www1, www2, www3) responds. In this system, the access dispersion is intended in the schedule function.

10 However, the above-described conventional access dispersion system has the following problems.

1) When the virtual host computer shown in Fig. 6 is utilized, a problem occurs that a device serving as an exclusive virtual host computer is separately
15 necessary.

2) Moreover, when the exclusive virtual host computer temporarily accepts all the accesses, and when there are many accesses, the processing ability of the virtual host computer raises a problem. Specifically,
20 the processing ability of the virtual host computer substantially indicates the processing ability of the web server site (the site in which the web server operates).

3) Moreover, in the virtual host computer system,
25 the access is accepted in the server site in which the virtual host computer is present, the access of the web server in its own server site is leveled, and the

respective virtual host computers are necessary for the
respective web server sites provided with the
dispersed/arranged web servers. Moreover,
predetermined different URLs need to be set in the
5 respective virtual host computers. Therefore, a
problem occurs that the accessing client has to select
the dispersed/arranged web server site by itself.

4) Furthermore, since the accessing client
selects the web server site, a problem occurs that the
10 accesses to the respective web server sites cannot be
leveled.

However, the transfer system by the TCP connection
hop as shown in Fig. 7 has an advantage that, different
from the virtual host computer system, a mechanism for
15 temporarily accepting the exclusive access is not
separately necessary.

5) However, the accesses are concentrated on the
web server in which the scheduler is permanently
stationed. Therefore, if a trouble is generated in the
20 web server in which the scheduler is permanently
stationed, a problem occurs that the entire server site
cannot function.

6) Moreover, in this system, the access to the
dispersed/arranged web server site cannot be controlled
25 to the optimum. Since the system is constituted for a
purpose of leveling the access in the web server site
(in its own network) managed by the scheduler,

predetermined different URLs need to be set in the respective web server sites similarly as the above-described virtual site system. Therefore, there is a problem that the accessing client selects the dispersed/arranged web server site by itself.

7) Furthermore, similarly as the above-described virtual site system, since the accessing client selects the web server site, the accesses to the respective web server sites cannot be leveled.

10

SUMMARY OF THE INVENTION

The present invention is constituted by a network status server comprising: logical distance obtaining means for obtaining respective logical distances between respective sites provided with dispersed/arranged information distribution servers and an accessed client; and site determination means for determining an optimum site from the respective sites provided with the dispersed/arranged information distribution servers based on the obtained logical distances.

Moreover, the present invention is constituted by a network status server comprising: logical distance obtaining means for obtaining respective logical distances between respective sites provided with dispersed/arranged information distribution servers and an accessed client; collection means for collecting

network state information between the respective sites
provided with the dispersed/arranged information
distribution servers and the accessed client, and state
information in the site provided with the
5 dispersed/arranged information distribution servers;
and server determination means for determining the
optimum information distribution server from the
dispersed/arranged information distribution servers
based on the logical distance obtained by the logical
10 distance obtaining means, the network state information
between the respective site provided with the
dispersed/arranged information distribution servers and
the accessed client, and the state information in the
sites provided with the dispersed/arranged information
15 distribution servers collected by the collection means.

Furthermore, the present invention is constituted
by a network status server comprising: logical distance
obtaining means for obtaining respective logical
distances between respective sites provided with
20 dispersed/arranged information distribution servers and
an accessed client; collection means for collecting
network state information between the respective sites
provided with the dispersed/arranged information
distribution servers and the accessed client, and state
25 information in the site provided with the
dispersed/arranged information distribution servers;
site determination means for, when it is judged that

the access from the client is a first access,
determining an optimum site from the respective sites
provided with the dispersed/arranged information
distribution servers based on the logical distance
5 obtained by the logical distance obtaining means; first
server determination means for determining an optimum
information distribution server from the information
distribution servers in the optimum site determined by
the site determination means based on a predetermined
10 condition; and second server determination means for,
when it is judged that the access from the client is
not the first access, determining the optimum
information distribution server from the
dispersed/arranged information distribution servers
15 based on the logical distance obtained by the logical
distance obtaining means, the network state information
between the respective sites provided with the
dispersed/arranged information distribution servers and
the accessed client, and the state information in the
20 site provided with the dispersed/arranged information
distribution servers collected by the collection means.

Moreover, according to the present invention,
there is provided an information distribution system
comprising: dispersed/arranged information distribution
25 servers; and a network status server.

The information distribution server comprises:
inquiry means for inquiring of the network status

server about the optimum information distribution
server among the dispersed/arranged information
distribution servers in response to an accessing
client; response reception means for receiving a
5 response from the network status server; and indication
means for indicating the optimum information
distribution server to the accessing client. The
network status server comprises: inquiry reception
means for receiving the inquiry from the inquiry means;
10 logical distance obtaining means for obtaining
respective logical distances between respective sites
provided with the dispersed/arranged information
distribution servers and the accessed client; site
determination means for determining the optimum site
15 from the respective sites provided with the
dispersed/arranged information distribution servers
based on the obtained logical distance; server
determination means for determining the optimum
information distribution server from the information
20 distribution servers in the optimum site determined by
the site determination means based on a predetermined
condition; and response transmission means for
returning the server determined by the server
determination means as the optimum server to the
25 information distribution server having transmitted the
inquiry.

Furthermore, according to the present invention,

there is provided an information distribution system comprising: dispersed/arranged information distribution servers; and a network status server.

The information distribution server comprises:

- 5 inquiry means for inquiring of the network status server about the optimum information distribution server among the dispersed/arranged information distribution servers in response to an accessing client; response reception means for receiving a
- 10 response from the network status server; and indication means for indicating the optimum information distribution server to the accessing client. The network status server comprises: inquiry reception means for receiving the inquiry from the inquiry means;
- 15 logical distance obtaining means for obtaining respective logical distances between respective sites provided with the dispersed/arranged information distribution servers and the accessed client; collection means for collecting network state
- 20 information between the respective sites provided with the dispersed/arranged information distribution servers and the accessed client, and state information in the site provided with the dispersed/arranged information distribution servers; server determination means for
- 25 determining the optimum information distribution server from the dispersed/arranged information distribution servers based on the logical distance obtained by the

logical distance obtaining means, the network state
information between the respective sites provided with
the dispersed/arranged information distribution servers
and the accessed client, and the state information in
5 the site provided with the dispersed/arranged
information distribution servers collected by the
collection means; and response transmission means for
returning the server determined by the server
determination means as the optimum server to the
10 information distribution server having transmitted the
inquiry.

Additionally, according to the present invention,
there is provided an information distribution system
comprising: dispersed/arranged information distribution
15 servers; and a network status server.

The information distribution server comprises:
inquiry means for inquiring of the network status
server about the optimum information distribution
server among the dispersed/arranged information
20 distribution servers in response to an accessing
client; response reception means for receiving a
response from the network status server; and indication
means for indicating the optimum information
distribution server to the accessing client. The
25 network status server comprises: inquiry reception
means for receiving the inquiry from the inquiry means;
logical distance obtaining means for obtaining

respective logical distances between respective sites
provided with the dispersed/arranged information
distribution servers and the client accessing the
information distribution server; collection means for
5 collecting network state information between the
respective sites provided with the dispersed/arranged
information distribution servers and the accessed
client, and state information in the site provided with
the dispersed/arranged information distribution
10 servers; site determination means for, when it is
judged that the access from the client is a first
access, determining the optimum site from the
respective sites provided with the dispersed/arranged
information distribution servers based on the logical
15 distance obtained by the logical distance obtaining
means; first server determination means for determining
the optimum information distribution server from the
information distribution servers in the optimum site
determined by the site determination means based on a
20 predetermined condition; second server determination
means for, when it is judged that the access from the
client is not the first access, determining the optimum
information distribution server from the
dispersed/arranged information distribution servers
25 based on the logical distance obtained by the logical
distance obtaining means, the information of the
network state between the respective sites provided

with the dispersed/arranged information distribution
servers and the accessed client collected by the
collection means, and the state information in the site
provided with the dispersed/arranged information
5 distribution servers; and response transmission means
for returning the server determined by the first server
determination means or the second server determination
means as the optimum server to the information
distribution server having transmitted the inquiry.

10 The present invention relates to the server, the
system, a control method of controlling the server and
system, or a storage medium for storing a control
program for controlling the server and system.

Since the present invention is constituted as
15 described above, the access load between the
dispersed/arranged web server sites can be leveled.

Moreover, the access between the
dispersed/arranged web server sites is leveled, while
the access load between the web servers in each web
20 server site can be leveled.

Furthermore, in order to determine the optimum web
server at a high speed, the optimum web server site is
first determined at a high speed by a first
determination method, and the true optimum web server
25 is then determined by a second determination method, so
that the optimum web server can be determined at the
speed as high as possible.

Additionally, in order to determine the optimum web server at a high speed, the accessed web server can detect the network state and server state at a high speed.

5 Moreover, the access client can be switched to the optimum web server without requiring any active operation.

10 Furthermore, when all the dispersed/arranged web servers accept the first access, the concentration of the accesses can be eliminated.

15 Other features and advantages of the patent invention will be apparent from the following description in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and together with the description, serve to explain the principles of the invention.

25 Fig. 1 is an explanatory view of a constitution according to an embodiment of the present invention.

 Fig. 2 is an explanatory view of a function and operation according to the embodiment of the present

invention.

Figs. 3A, 3B, 3C, 3D and 3E are flowcharts showing the function and operation according to the embodiment of the present invention.

5 Fig. 4 is an explanatory view showing the function and operation of an NS server according to the embodiment of the present invention.

10 Fig. 5 is an explanatory view showing the function and role according to the embodiment of the present invention.

Fig. 6 is an explanatory view of a conventional virtual host computer system.

Fig. 7 is an explanatory view of a conventional TCP connection hop system.

15 Fig. 8 is a diagram showing an approximation curve during approximation of collected information with a predetermined function.

20 Fig. 9 is a block diagram of a computer which can be realized by an NS server, information distribution server and route server of the present invention.

Fig. 10 is a schematic view showing a storage medium for storing a program code and a transmission device for transmitting the program code.

25 Fig. 11 is an image diagram showing the memory map of the storage medium for storing a network status server control program or an information distribution system control program in the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention will be described in detail hereinafter with reference to the drawings. Fig. 1 is a constitution system diagram of an optimum server selection system of the present invention. Shown is an example in which Internet is used as communication means between respective sites. In Fig. 1, a terminal side site 1 accesses an information distributing server, and a server site 2 is provided with an accessed information distributing server (hereinafter referred to as the information distribution server or the web server). Here, the site means the same logical network block, and indicates, for example, the address block of class B or C as a network address class. Of course, even when the block is physically in the same place, it can be regarded as the site. Moreover, in the present embodiment, the server site 2 is dispersed and disposed to perform high-speed large-capacity information distribution. Fig. 1 shows dispersed/arranged server sites 12. Numeral 3 denotes Internet as communication means among the respective sites. In the present embodiment, the communication means among the sites is Internet, but is not limited to this, and for example, a packet communication network, a public network (telephone network), and the like may be used.

A terminal 4 accesses the information distribution

server, and is an information processor in which a standard browser accessible to the information distribution server (web server) is installed in the present embodiment. A terminal side router 5 is a router for performing the path control of the inside and outside of an access side site. A site side router 6 is a router for performing the path control of the inside and outside of the site provided with the information distribution server.

10 In an information distribution server 7, a web server software 8 as a standard information distributing software and an agent software 9 newly prepared in the present invention operate. The web server software 8 is a server software provided with a function of transferring information written in html language in response to a request from the outside. Moreover, the agent software 9 is a software provided with various server operation situations and indications for the web server software 8.

15 20 Additionally, needless to say, the information distribution server may operate with the software integrally formed by the web server software 8 and agent software 9.

25 The respective site side routers 6 are provided with the path information obtained when the respective sites view the other sites through Internet (network). A route server 10 is provided with a function of

obtaining path information (e.g., BGP information, RIP information, OSPF information, and the like) from the respective site side routers 6. Moreover, the route server 10 has a function of transmitting the path
5 information to a network status server (hereinafter referred to as the NS server) 11.

The NS server 11 instructs the agent 9 to measure various operation states of the site 2 provided with the dispersed/arranged information distribution servers
10 and the information distribution servers in the site 12, and obtains and stores measurement results. Moreover, the agent 9 measures the network states (e.g., congestion degree, router step number, packet loss ratio, response time, and the like) between
15 terminal side site 1 having requested for the information and the respective information distribution servers 2 and 12, and the NS server 11 obtains and stores the network states measured by the agent 9. Furthermore, the NS server 11 obtains the information
20 from the route server 10 to obtain the network distance between the terminal side site 1 having requested for the information and the sites 2 and 12 provided with the respective information distribution servers.

Additionally, in Fig. 1, the route server 10 and
25 NS server 11 are in the site 2, but are not limited in the site 2, and may be in any other site.

An operation for controlling the access to the

optimum web server in the present embodiment will next be described. First, Fig. 2 is a schematic view of the web server access. Here, an operation performed when the terminal 4 of the site 1 accesses the web server is concretely shown. Shown is a case in which the terminal 4 in the autonomous (AS) system 1 accesses the web server provided with the access address (hereinafter referred to as URL) of the web site of www.abcde.jp. First, in order to obtain the IP address of the target web server, a nearest domain name server (DNS) in its network (site 1) is inquired from the URL, and the corresponding IP address (addr1) is received (201). Subsequently, the desired web site (the web site having the URL of www.abcde.jp) is accessed (= requested) by the IP address (addr1) (202). When the web server A having the IP address (addr1) accepts the access, the agent 9 inquires of the network status server (NS server) whether or not the web server is an optimum server for the accessed client (203). The NS server inquires of the route server 10 about the network distance between the respective sites 2, 3, 4 provided with the dispersed/arranged web servers and the accessed client site 1 (204). Since the route server 10 exchanges the path information with the border gateway router 6 in each site, the distance between each site and the client site 1 can quickly be returned (205). The NS server 11 receives the response

from the route server 10, determines the site 3 as the closest site in the network, and returns the URL of the optimum web server B to the agent 9 of the site 4 (206). Alternatively, the IP address (addr2) of the optimum web server may be returned. In the present embodiment, the AS path information of the border gateway protocol (BGP) is used as a site selection method at this time (when the client first accesses the site) so that the information can quickly be obtained.

For this the site 3 is selected as the site with a short AS path from each web server to the client site, and a predetermined method is used to select the web server B having addr2 in the site 3 as the optimum web server.

Additionally, in addition to the path information, the NS server operates to obtain number of routers between each site and the client (router hop number), response time, network information such as a packet loss ratio, network information in each site (congestion degree, number of packets, number of packet errors, and the like), server load situation (CPU load ratio, CPU idle ratio, number of connection links, disk load ratio, and the like), and other information. The NS server prepares for the next inquiry and stores the information (including temporary storage) (207).

The agent 9 in the web server A instructs the client 4 to access the web server B during the next

access (208). For example, the web server to be
connected to the client can automatically be changed
using the location command of the HTML language. As a
result, the client 4 will automatically access the
5 optimum web server B from the next access.

An operation performed when the client 4
continuously accesses the web server B will next be
described similarly with reference to Fig. 2. The web
server B is accessed through the above-described
10 process (209). When the web server B accepts the
access, the agent 9 inquires of the NS server 11
whether or not the web server itself is an optimum
server for the accessed client (210). The NS server 11
collects the path information and integrates various
15 state information similarly as the operation during the
above-described first access and determines the optimum
server site and optimum web server. In addition to the
path information obtained and stored by the previous
access, the NS server 11 obtains number of routers
20 between each site and the client (number of router
hops), response time, network information such as the
packet loss ratio, network information in each site
(congestion degree, number of packets, number of packet
errors, and the like), and server state information
25 (CPU load ratio, CPU idle ratio, number of connection
links, disk load ratio, and the like) which could not
be inspected during the previous access, and the

optimum web server to be accessed by the client is calculated and determined from the obtained various information. At this time the selection method comprises applying a numeric weight to each information in accordance with the content, and comparing the total weight for each site or each server to determine the optimum web server C (211). As a result, the client 4 will automatically access the optimum web server C from the next access (214).

Furthermore, when the client 4 successively accesses the web server C, the operation similar to the above-described operation of accessing the web server B is performed (215, 216), but the operation of accessing the NS server is performed after a predetermined time.

Subsequently, when a new optimum web server is determined by the obtained and stored various network state information and server state information in the predetermined time, the client 4 changes the access to the new web server.

An operation of controlling the access to the optimum web server of the present embodiment will next be described with reference to Figs. 3A to 3E. Fig. 3A is a flowchart showing an operation performed from when the access client first accesses the web server A until the access is changed to the first optimum web server B. Fig. 3B is a flowchart showing the operation of the NS server. Fig. 3C is a flowchart showing an operation

performed from when the access client next accesses the web server B until the access is changed to the optimum access web server C. Fig. 3D is a flowchart showing the operation of the NS server. Fig. 3E is a flowchart showing an operation performed from when the access client accesses the web server C and further inspects the optimum access web server until the web server C is again accessed.

The operation will first be described with reference to Figs. 3A, 3B. In order to obtain the IP address of the target web server from the URL, the closest domain name server (hereinafter abbreviated as DNS) in its network (site 1) is inquired, and the corresponding IP address (addr1) is received (S1).

Subsequently, the desired web site A is accessed by the IP address (addr1) (S2).

When the web server A accepts the access, the agent 9 inquires of the NS server whether or not the web server is an optimum server for the accessed client (S3).

In the NS server, the network distance from the dispersed/arranged respective web server sites to the accessed client site 1 is inquired of the route server 10 (S4).

Since the route server 10 exchanges the path information with the site side router 6 in each site (hereinafter referred to as the border gateway router),

the distance from each site to the client site 1 can quickly be returned, and the NS server obtains the path information and distance (S5).

5 The NS server 11 receives the response from the
route server 10, fixes the site 3 as the close site in
the network, determines the optimum web server B in the
site 3 in a predetermined method, and answers the agent
9 of the site 4 that the optimum web server is the web
server B (S6). Additionally, the predetermined method
10 of fixing the optimum web server in S6 may comprise
predetermining the web server for each site,
determining the web server in a predetermined order for
each site, or arbitrarily determining the web server in
the site. Moreover, since the NS server obtains the
15 state information in the site provided with the web
server (e.g., the information of the network state in
the site such as the congestion degree, number of
packets and packet errors, and the server state
information such as CPU load ratio, CPU idle ratio,
20 number of connection links and disk load ratios), the
optimum web server may be determined utilizing the
state information in the site.

 The NS server stores the obtained path information
(including the temporary storage) to prepare for the
25 next inquiry (S7).

 On the other hand, the agent 9 in the web server A
answers the client 4 that the optimum web server B is

accessed from the next access (S8).

As a result, the client 4 will automatically access the optimum web server B from the next access.

The operation will next be described with
5 reference to Figs. 3C, 3D.

The web server B is accessed through the above-described process (S9).

When the web server B accepts the access, the agent 9 inquires of the NS server 11 whether or not the
10 web server is an optimum server for the accessed client (S10).

The NS server 11 collects the path information and integrates various state information similarly as the operation during the above-described first access and
15 determines the optimum server site and optimum web server. In addition to the path information obtained and stored by the previous access, the NS server 11 obtains number of routers between each site and the client (router hop number), response time, network
20 information such as the packet loss ratio, network information in each site (congestion degree, number of packets, packet error, and the like), and web server state information (CPU load ratio, CPU idle ratio, number of connection links, disk load ratio, and the
25 like) which could not be inspected during the previous access, and the optimum web server to be accessed by the client is calculated and determined from the

obtained various information. At this time the selection method comprises applying the numeric weight to each information in accordance with the content, and comparing the total weight for each site or each server to determine the optimum web server C (S11).

The NS server 11 notifies the agent 9 in the web server B of the optimum web server C (S12), and further answers the client 4 that the optimum web server C is accessed from the next access (S13).

As a result, the client 4 will automatically access the optimum web server C from the next access (S14).

Finally, the operation will be described with reference to Fig. 3E. When the client 4 successively accesses the web server C, the optimum web server is inquired of the NS server similarly as the above-described access to the web server B (S15), but here the web server C is judged to be the optimum web server similarly as the previous access, and the processing for changing the web server to be accessed (S16) is not performed. However, when it is answered in S15 that the web server different from the web server C is the optimum web server, needless to say the processing for changing the web server to be accessed is performed.

Additionally, the operation of accessing the NS server is intermittently performed after a predetermined time. Subsequently, when a new optimum

web server is determined by the obtained and stored various network state information and server state information in the predetermined time, the client 4 changes the access to the new web server.

5 An operation will next be described with reference to Fig. 4, in which the NS server 11 obtains and stores the state of the network from the web server to the client, the state of the network in the web server site, and information on the web server state.

10 In the present system, the following two categories of information are periodically (intermittently) collected:

(1) Network state from each server site to the client;

15 (2) State in each server site (network state, server state).

Fig. 4 shows a relation. The NS server 11 periodically measures the network state from each server site to the accessed client. Items to be
20 measured are described later.

Each server site router 6 holds the network path information seen from the server site, and the route server 10 collects the path information owned by the router from each server site router 6. The route
25 server 10 has a logical connection as being peer-to-peer with each server site router 6, that is, the border gateway router (BGR) or an external network

border router (401). Subsequently, the analysis result of the predetermined path information is obtained in response to the request from the NS server 11, and returned to the NS server 11 (402). For other
5 inspection items, the NS server autonomously performs the inspection (403), but in some cases the NS server 11 instructs the agent software 9 incorporated in each web server software to perform inspection in accordance with the inspection content.

10 For the network and server states in each server site, the agent software 9 incorporated in the web server software of each server site periodically performs the inspection in accordance with the instruction from the NS server 11. The collected
15 various information are stored in the NS server in time series. In this data storage method, time is intermittently stored as information attached to the various information. In the present embodiment, various information are inspected, obtained, and stored
20 every 30 minutes. Moreover, it is empirically known that the stored information periodically changes in predetermined periods such as a day unit, week unit, month unit, and year unit. Therefore, in the present system, the stored information is approximated with a
25 predetermined function.

The time unit for the approximation may be any one of the day unit, week unit, month unit, and year unit,

but in the present embodiment, various information are approximated by the day unit by a three-dimensional function and a coefficient is saved. For example, when the congestion degree (CSn) of the network in the server site is approximated with the three-dimensional function, a time axis is set to t, and the approximation is performed with an approximation curve shown in Fig. 8. When the approximation equation is represented as $CSn = a \cdot t^3 + b \cdot t^2 + c \cdot t + d$ (a, b, c, d being coefficients), the NS server saves this coefficient (the three-dimensional function itself may be saved).

As a result, when the request for selecting the optimum server is received from each server, by utilizing the three-dimensional function, various states are momentarily estimated, and the optimum server is selected based on the estimated value.

The collection of the network state information between each server site and the access client is not infinitely continued, and is continued while the access to the dispersed/arranged servers is continued and for a predetermined period after that. In the present embodiment, the period is set to one week. When there is no access from the access client 4 for one week, the information collecting operation to the access client 4 from each site is not performed.

Moreover, when there is no access from the access

client 4 for the predetermined period (e.g., three weeks), the network state information (the approximation equation, and the like) between the access client 4 and each server site stored in the NS server stored in the NS server may be discarded. In this case, no wasteful information is stored, and the storage capacity necessary for the NS server can advantageously be saved.

Furthermore, when there is no access from the access client 4 for the predetermined period, the path information between the access client 4 and each server site stored in the NS server may also be discarded.

Additionally, the stored information can also be treated as the result representative of a specific area. Specifically, the NS server obtains and stores the path information (logical distance) between each server site and the access client or the network state information between each server site and the access client. For the path information (logical distance) between each server site and the access client, the path information (logical distance) between each server site and the site to which the access client belongs may be utilized. For the network state information between each server site and the access client, the network state information between each server site and the access client may be utilized.

For example, when the IP address of the access

client 4 is 192.168.0.1, the network state with this client is used as the result of the entire class C address block. Specifically, for the access from the network block of 192.168.0.0/24, the already inspected and obtained information of 192.168.0.1 is used. In this case, the memory space for the data to be stored can be reduced. In the present embodiment, the access client area is classified with the class B access (the network address block corresponding to A.B.0.0/16).

The network and information distribution server state information autonomously inspected and obtained by the NS server 11 will next be described.

(1) The network state information from each information distribution server site to the client are as follows:

- ASLn: distance between the logical networks by AS path (BGP path information is used);
- RTn: response time;
- RNn: number of router steps (number of router hops); and
- PLn: packet loss ratio.

(2) The state (network, server) information in each information distribution server site are as follows:

- as the network state information in the site,
- CSn: congestion degree in the site;
 - PSn: number of packets in the site; and

- ESn: packet error,
as the information distribution server state
information,

- CPU_{nm}: CPU load ratio;
- 5 • IDLE_{nm}: CPU idle value;
- LINK_{nm}: number of connection links; and
- IO_{nm}: disk load ratio,

additionally, n: server site number, m: server number.

A method of using these network and server state
10 information to determine the optimum server. The NS
server 11 stores these various state information, and
uses these information to determine the optimum server
site and server. In the present embodiment, these are
calculated using the following equation.

15 A selection method I corresponds to the selection
method in the step S6 in Fig. 3B, and the site in which
ASL_n is minimum is fixed as the optimum site.

A selection method II corresponds to the selection
method in the step S11 in Fig. 3D.

20 A network state value K1_n between the server site
and the client, a network state value K2_n in the server
site, and a server state value are obtained, and an
optimum site judgment value K_n is obtained for each
server site as shown by the following equation. The
25 site number (n) in which the value is minimum is fixed
as the optimum site. Subsequently, an optimum server
judgment value S_{nm} is obtained using K3_{nm}. The optimum

server judgment value is obtained from the optimum site judgment value and server state value. Therefore, by using the network state of the client site and server site, network state in the site, server state, and logical distance between the networks with weight coefficients A to O, the optimum server is generally judged. Additionally, here, the server in which S_{nm} is minimum is fixed as the optimum server.

Network state value: $K_{1n} = R_{Tn} \cdot A + R_{Nn} \cdot B + P_{Ln} \cdot C$

10 In-site network state value: $K_{2n} = C_{sn} \cdot D + P_{Sn} \cdot E + E_{Sn} \cdot F$

Server state value:

$K_{3nm} = CPU_{nm} \cdot G + IDLE_{nm} \cdot H + LINK_{nm} \cdot I + IO_{nm} \cdot J$

Optimum site judgment value: $K_n =$
15 $K_{1n} \cdot K + K_{2n} \cdot L + AS_{Ln} \cdot M$

Optimum server judgment value: $S_{nm} = K_n \cdot N + K_{3nm} \cdot O$

Additionally, n: number of server sites, m: number of servers, A to O: weight coefficients.

Moreover, in the present embodiment, the response
20 time, number of router steps (number of router hops), and packet loss ratio are used as the network state value, the congestion degree in the site, number of packets in the site, and packet error are used as the in-site network state value, and CPU load ratio, CPU
25 idle value, number of connection links, and disk load ratio are used as the server state value, but with respect to the network state value, in-site network

state value and server state value, at least one of the utilized information in the present embodiment may be utilized.

Moreover, the network state information in the
5 site and the state information of the information
distribution server are utilized as the state
information in the server site, but either one may be
used as the representative during the determination of
the optimum server.

10 The function of the route server used in the
present system will next be described with reference to
Fig. 5. The current Internet/Intranet is said to be an
environment in which routers are connected in a mesh
manner. In the system, in order to distribute the
15 desired packet to a specific place, a routing protocol
is used, and the routing protocol called Border Gateway
Protocol (BGP) is used in a wide network. In the BGP,
each router is provided with a path table, and the
packet is distributed to the specific place based on
20 this path table.

In Fig. 5, the route server 10, each site router
and BGP are logically connected as being peer-to-peer.
Here, as one technique of measuring the distance
between each site and the client, AS-path number is
25 utilized. This AS-path number means the number of
independent networks treated in the BGP, and the path
information up to the desired AS number are mapped as

the connection of AS numbers in the path information. Specifically, the path information between the server site and the client site can be known as the connection of AS numbers applied to the independent networks. The
5 AS-path number indicates the frequency at which the independent networks are passed, and can be known from the connection of the AS numbers.

The route server can collect the path information viewed from each server site by obtaining the path
10 information from the router 6 in each server site, and the server site closest to the access client (in the AS path) can be selected.

In the present embodiment, this route server is used to obtain the BGP distance between the access
15 client and each server site, that is, the AS-path number, and the distance is used as one of the selection conditions for determining the optimum server site.

Moreover, in the present embodiment, used are the
20 selection method I of obtaining the optimum site from the logical distance from the server site to the client and then determining the information distribution server in the optimum site in the predetermined method, and the selection method II of determining the optimum
25 information distribution server from the logical distance, network state information and information distribution server state information. For the first

access from the client, the selection method I is used to determine the optimum server, and for the second and subsequent accesses, the selection method II is used to determine the optimum server, but the present invention
5 is not limited to this order, and the selection method I may constantly be used, or the selection method II may be used.

Moreover, when the client accesses the NS server, and the path information (logical distance) between the
10 client and the server site is stored, the stored path information may be utilized to determine the optimum server.

Furthermore, the NS server, information distribution server and route server of the present
15 invention can be realized by the information processor with a constitution equal to that of the computer shown in Fig. 9. A computer 901 of Fig. 9 is constituted of a CPU 902 for reading a program to perform an actual processing, RAM 903 used by the CPU 902 during the
20 processing, hard disk (hereinafter referred to as HD) 904 as the storage medium for supplying a program code, floppy disk (FD) 905, communication interface 906 used during connection to the network, and the like. The network status server control program and information
25 distribution system control program of the present invention may be performed by the computer with the constitution equal to that of Fig. 9 by the program

installed from the outside. In this case, as shown in Fig. 10, needless to say, the object of the present invention is achieved by providing the system or the device with a recording medium 1002 in which the software program code for realizing the function of the above-described embodiment is recorded, and reading and executing the program code stored in the storage medium by the computer (or CPU or MPU) of the system or the device.

10 In this case, the program code itself read from the storage medium realizes the inventive function of the present invention, and the storage medium for storing the program code constitutes the present invention.

15 As the storage medium for supplying the program code, for example, magnetic disks such as a floppy disk and hard disk, optical disks, optical magnetic disks, CD-ROM, CD-R, DVD-ROM, DVD-RAM, magnetic tapes, memory cards, ROM, and the like can be used.

20 Moreover, it goes without saying that the present invention can be applied to a case in which the program is distributed from the storage medium for recording the program code of the software for realizing the function of the above-described embodiment via the communication line of the personal computer
25 communication, and the like.

Fig. 11 is a diagram showing one example of the

memory map of storage media such as the CD-ROM for supplying the program code. An area 1101 for storing directory information indicates the positions of an area 1102 for storing an install program, and an area 1103 for storing control programs such as a network status server control program and an information distribution system control program. When the network status server control program or the information distribution system control program of the present invention is installed in the computer, the install program stored in the area 1102 is loaded to the system, and executed by the CPU. Subsequently, the install program executed by the CPU reads the network status server control program or the information distribution system control program from the area 1103 for storing the control programs such as the network status server control program and information distribution system control program and stores the program in the hard disk.

When the present invention is applied to the storage medium, the storage medium stores the program code corresponding to the flowchart described above.

Moreover, it goes without saying that, as shown in Fig. 10, the object of the present invention is achieved by transmitting the program code of the software for realizing various functions in the above-described embodiment from a transmission device 1004,

for example HTTP server or FTP server, receiving the code via a network 1005, public line or radio, and executing the program code by the computer (or CPU, MPU) of the system or device.

5 In this case, since the program code itself transmitted from the transmission device realizes the function in the above-described embodiment, the transmission device for transmitting the program code constitutes the present invention.

10 Moreover, the present invention can be applied not only to the realization of the function of the above-described embodiment by executing the program code read by the computer but also to the realization of the function of the above-described embodiment by
15 performing a part or the whole of the actual processing by the OS, and the like operating on the computer based on the instruction of the program code.

 As described above, according to the present embodiment, there is an effect that the access load
20 between the dispersed/arranged web server sites can be leveled.

 Moreover, the access between the dispersed/arranged web server sites is leveled, and the access load can effectively be leveled even between the
25 web servers in each web server site.

 Furthermore, in order to determine the optimum web server at a high speed, when the client has a first

access, the optimum web server site is determined using the path information (logical distance) at a high speed in the first determination method. In the subsequent access from the client, the optimum web server can be
5 determined at a high speed by using not only the path information but also the network state information and the state information in the web server site in the second determination method to determine the optimum web server, which produces an effect that the web
10 server can respond to the access client at a high speed.

Additionally, since the network state information and server state information necessary for recognizing the optimum web server are automatically obtained and
15 stored in the NS server, or the NS server obtains and stores the information, and the optimum web server is generally determined by the information, there is an effect that the accessed web server can determine the optimum web server at a high speed.

20 Moreover, the client is switched to the optimum web server without adding the separate device or requiring any active operation, and all the web servers in the dispersed/arranged web server sites can accept the access, the concentration of the accesses can
25 effectively be eliminated.